

TABLE 1 TO § 1033.520—LINE-HAUL LOCOMOTIVE RAMPED MODAL CYCLE—Continued

RMC test phase	Weighting factor	RMC mode	Time in mode (seconds)	Notch setting
Pre-test idle	NA	NA	600 to 900	Lowest idle setting <sup>1</sup>
(Idle test) .....	0.380	B	600	Normal Idle.
Phase Transition				
Phase 2 .....	0.389	C 1 2 3 4 5	1000 520 520 416 352 304	Dynamic Brake. <sup>3</sup> Notch 1. Notch 2. Notch 3. Notch 4. Notch 5.
Phase Transition				
Phase 3 .....	0.231	6 7 8	144 111 600	Notch 6. Notch 7. Notch 8.

<sup>1</sup> See paragraph (d) of this section for alternate pre-test provisions.<sup>2</sup> Operate at normal idle for modes A and B if not equipped with multiple idle settings.<sup>3</sup> Operate at normal idle if not equipped with a dynamic brake.

TABLE 2 TO § 1033.520—SWITCH LOCOMOTIVE RAMPED MODAL CYCLE

RMC test phase	Weighting factor	RMC mode	Time in mode (seconds)	Notch setting
Pre-test idle	NA	NA	600 to 900	Lowest idle setting <sup>1</sup>
Phase 1 (Idle test) .....	0.598	A B	600 600	Low Idle. <sup>2</sup> Normal Idle.
Phase Transition				
Phase 2 .....	0.377	1 2 3 4 5	868 861 406 252 252	Notch 1. Notch 2. Notch 3. Notch 4. Notch 5.
Phase Transition				
Phase 3 .....	0.025	6 7 8	1080 144 576	Notch 6. Notch 7. Notch 8.

<sup>1</sup> See paragraph (d) of this section for alternate pre-test provisions.<sup>2</sup> Operate at normal idle for modes A and B if not equipped with multiple idle settings.

[73 FR 37197, June 30, 2008, as amended at 74 FR 8424, Feb. 24, 2009]

### § 1033.525 Smoke testing.

This section describes the equipment and procedures for testing for smoke emissions when is required.

(a) This section specifies how to measure smoke emissions using a full-flow, open path light extinction smokemeter. A light extinction meter consists of a built-in light beam that traverses the exhaust smoke plume that issues from exhaust the duct. The light beam must be at right angles to

the axis of the plume. Align the light beam to go through the plume along the hydraulic diameter (defined in 1065.1001) of the exhaust stack. Where it is difficult to align the beam to have a path length equal to the hydraulic diameter (such as a long narrow rectangular duct), you may align the beam to have a different path length and correct it to be equivalent to a path length equal to the hydraulic diameter. The light extinction meter must meet the requirements of paragraph (b) of this section and the following requirements:

§ 1033.530

40 CFR Ch. I (7–1–10 Edition)

(1) Use an incandescent light source with a color temperature range of 2800K to 3250K, or a light source with a spectral peak between 550 and 570 nanometers.

(2) Collimate the light beam to a nominal diameter of 3 centimeters and an angle of divergence within a 6 degree included angle.

(3) Use a photocell or photodiode light detector. If the light source is an incandescent lamp, use a detector that has a spectral response similar to the photopic curve of the human eye (a maximum response in the range of 550 to 570 nanometers, to less than four percent of that maximum response below 430 nanometers and above 680 nanometers).

(4) Attach a collimating tube to the detector with apertures equal to the beam diameter to restrict the viewing angle of the detector to within a 16 degree included angle.

(5) Amplify the detector signal corresponding to the amount of light.

(6) You may use an air curtain across the light source and detector window assemblies to minimize deposition of smoke particles on those surfaces, provided that it does not measurably affect the opacity of the plume.

(7) Minimize distance from the optical centerline to the exhaust outlet; in no case may it be more than 3.0 meters. The maximum allowable distance of unducted space upstream of the optical centerline is 0.5 meters. Center the full flow of the exhaust stream between the source and detector apertures (or windows and lenses) and on the axis of the light beam.

(8) You may use light extinction meters employing substantially identical measurement principles and producing substantially equivalent results, but which employ other electronic and optical techniques.

(b) All smokemeters must meet the following specifications:

(1) A full-scale deflection response time of 0.5 second or less.

(2) You may attenuate signal responses with frequencies higher than 10 Hz with a separate low-pass electronic filter with the following performance characteristics:

(i) Three decibel point: 10 Hz.

(ii) Insertion loss:  $0.0 \pm 0.5$  dB.

(iii) Selectivity: 12 dB down at 40 Hz minimum.

(iv) Attenuation: 27 dB down at 40 Hz minimum.

(c) Perform the smoke test by continuously recording smokemeter response over the entire locomotive test cycle in percent opacity to within one percent resolution and also simultaneously record operator demand set point (e.g., notch position). Compare the recorded opacities to the smoke standards applicable to your locomotive.

(d) You may use a partial flow sampling smokemeter if you correct for the path length of your exhaust plume. If you use a partial flow sampling meter, follow the instrument manufacturer's installation, calibration, operation, and maintenance procedures.

§ 1033.530 Duty cycles and calculations.

This section describes how to apply the duty cycle to measured emission rates to calculate cycle-weighted average emission rates.

(a) *Standard duty cycles and calculations.* Tables 1 and 2 of this section show the duty cycle to use to calculate cycle-weighted average emission rates for locomotives equipped with two idle settings, eight propulsion notches, and at least one dynamic brake notch and tested using the Locomotive Test Cycle. Use the appropriate weighting factors for your locomotive application and calculate cycle-weighted average emissions as specified in 40 CFR part 1065, subpart G.

TABLE 1 TO § 1033.530—STANDARD DUTY CYCLE WEIGHTING FACTORS FOR CALCULATING EMISSION RATES FOR LOCOMOTIVES WITH MULTIPLE IDLE SETTINGS

Notch setting	Test mode	Line-haul weighting factors	Line-haul weighting factors (no dynamic brake)	Switch weighting factors
Low Idle .....	A .....	0.190	0.190	0.299